

## GRADE 8 STANDARDS AND LEARNING ACTIVITIES

## Strand: Number Sense and Operations

## NUMBER SENSE

**8.NSO–N.1.** Explain the properties of and compute with real numbers expressed in a variety of forms..

*Example: A hole in a piece of metal has a diameter of  $3\frac{1}{2}$  inches. Which of the following pipes is the largest that will fit through the hole?*

A. a pipe with diameter  $3\frac{3}{8}$  inches

B. a pipe with diameter  $3\frac{7}{8}$  inches

C. a pipe with diameter  $3\frac{5}{16}$  inches

D. a pipe with diameter  $3\frac{7}{16}$  inches

(See also 6.NSO–N.2, 7.NSO–N.1)

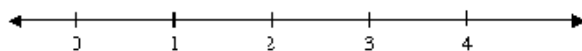
**8.NSO–N.2.** Know that every rational number is either a terminating or repeating decimal and that every irrational number is a nonrepeating decimal.

**8.NSO–N.3.** Know that the absolute value is the distance of the number from 0; determine the absolute value and additive inverse of real numbers; determine the absolute value of rational numbers.

**8.NSO–N.4.** Read, write, and compare rational numbers in scientific notation (positive and negative powers of 10), and use them in calculations and problem situations.

**8.NSO–N.5.** Define, compare, order, and apply frequently used irrational numbers, such as  $\sqrt{2}$  and  $\pi$  (e.g., show that if  $\pi$  is known to be irrational, then  $3\pi$  and  $\pi/3$  also are irrational).

*Example: Locate  $\sqrt{2}, \sqrt{3}, \sqrt{4}, \sqrt{5}$  on the following number line.*



(See also 7.NSO–N.9)

**8.NSO–N.6.** Use the laws of exponents for integer exponents (e.g., write  $2^2 \times 2^3$  as  $2 \times 2 \times \dots$  and then as a single power of 2; write  $2^{-3}$  as a fraction).

*Example:  $(0.5)^3$  is equal to which of the following?*

A. 0.000125

B. 0.00125

C. 0.125

D. 1.25

(See also 7.NSO–N.6)

**8.NSO–N.7.** Demonstrate an understanding of the properties of arithmetic operations on rational numbers.

## COMPUTATION AND OPERATIONS

**8.NSO–C.8.** Calculate weighted averages such as course grades, consumer price indexes, and sports ratings.

*Example: Mr. Miller's English class has 22 students and the class average on the first exam was a 78. Ms. Chaucer's class has 28 students and a class average of 80 on the same exam. What is the average grade for the combined class?*

**8.NSO–C.9.** Solve problems involving ratio units such as miles per hour, dollars per pound, or persons per square mile.

**8.NSO–C.10.** Solve problems involving derived quantities such as density, velocity, and weighted averages.

**Strand: Number Sense and Operations (continued)**

**COMPUTATION AND OPERATIONS (CONTINUED)**

**8.NSO-C.11.** Solve problems that involve markups, commissions, profits, and simple and compound interest.

*Example: You purchase one dollar of stock in Global Enterprises, Inc. On day 1, it rises 50% in value. On day 2, it falls 50% in value. On day 3, it rises 50% in value. On day 4, it falls 50% in value. How much (to the nearest penny) is it worth at the end of day 4?*

*(see also 7.NSO-C.13)*

*Example: If you use a realty agent to sell your house, the agent's fee is 4% of the selling price for the house. How much should you ask for your house if you want to be sure that you collect \$220,000 after the agent has taken her fee?*

*(See also 7.NSO-C.13)*

**8.NSO-C.12.** Apply the rules of powers and roots to the solution of problems.

**8.NSO-C.13.** Use the inverse relationship between squaring and finding the square root of a perfect square integer to solve problems.

**8.NSO-C.14.** Multiply and divide numbers written in scientific notation.

**8.NSO-C.15.** Select and use appropriate operations – addition, subtraction, multiplication, division, and positive integer exponents – to solve problems with rational numbers, including negative rationales.

**ESTIMATION**

**8.NSO-E.16.** Estimate and solve problems with square roots; find square roots of perfect squares and approximate the square roots of nonperfect squares by locating them between consecutive integers.

*Example: Which is the best approximation for  $\sqrt{72}$ ?*

A. 7.2

B. 9.1

C. 8.9

D. 8.5

*Example: For an integer that is not a perfect square, find the two integers (one larger, one smaller) that are closest to its square root and explain your reasoning.*

**8.NSO-E.17.** Determine estimates to a certain stated accuracy.

**Strand: Patterns, Relations, and Algebra**

**8.PRA.1.** Use tables and graphs to represent and compare linear growth patterns. In particular, compare rates of change and x- and y-intercepts of different linear patterns.

**8.PRA.2.** Set up and solve linear equations and inequalities with one or two variables using algebraic methods and graphs.

*Example: Al got an estimate for repairs on his bike. The parts will cost \$17.50, and the parts and labor together will not be more than \$40. Which inequality shows the possible labor costs, L?*

A.  $40 + 17.50 \geq L$

B.  $40 + L \geq 17.50$

C.  $17.50 + L \leq 40$

D.  $L - 17.50 \leq 40$

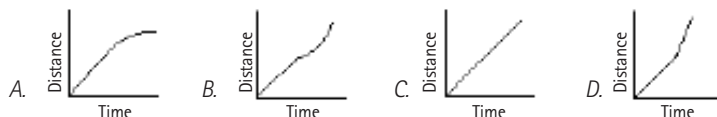
*(See also 7.PRA.5, 7.PRA.10, 8.PRA.6, A.I.P.2, A.I.P.13, A.II.P.7, A.II.P.9)*

**Strand: Patterns, Relations, and Algebra** *(continued)*

**8.PRA.3.** Use linear equations to model and analyze problems involving proportional relationships.

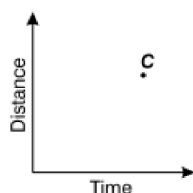
**8.PRA.4.** Identify the slope of a line as a measure of its steepness and as a constant rate of change from its table of values, equation, or graph. Apply the concept of slope to the solution of problems.

*Example: Kathy rode her bicycle from her house to the top of a nearby hill. First, she traveled very fast on a level road. Then, she traveled more and more slowly as she went up the hill. Which graph best shows the distance she traveled over time?*



(See also 6.PRA.3, 6.PRA.9, 7.M.3, 8.PRA.8, G.G.18)

*Example: Point C on the graph below represents the distance and time that Catlyn traveled on her trip. Which of the following represents her average speed?*



- A. x-coordinate of point C
- B. y-coordinate of point C
- C. slope of line through C and (0,0)
- D. distance from the origin to point C

(See also 7.PRA.11, AI.P.5, AI.P.14, AI.D.1)

**8.PRA.5.** Identify the roles of variables within an equation (e.g.,  $y = mx + b$ , expressing  $y$  as a function of  $x$  with parameters  $m$  and  $b$ ).

**8.PRA.6.** Distinguish between numerical and algebraic expressions, equations, and inequalities.

**8.PRA.7.** Interpret the formula  $(-x)(-y) = xy$  in calculations involving such things as distance, speed, and time, or in the graphing of linear functions. Use this identity to simplify algebraic expressions [e.g.,  $(-2)(-x + 2) = 2x - 4$ ].

**8.PRA.8.** Explain and analyze – both quantitatively and qualitatively, using pictures, graphs, charts, and equations – how a change in one variable results in a change in another variable in functional relationships e.g.,  $C = \pi d$ ,  $A = \pi r^2$  ( $A$  as a function of  $r$ ),  $A_{\text{rectangle}} = lw$  ( $A_{\text{rectangle}}$  as a function of  $l$  and  $w$ ).

*Example: The formula for the volume ( $V$ ) of a cube is*

$$V = e^3$$

*where  $e$  is the length of an edge.*



*Example: An edge of a silver cube is twice as long as an edge of a gold cube. How many times greater is the volume of a silver cube than that of a gold cube?*

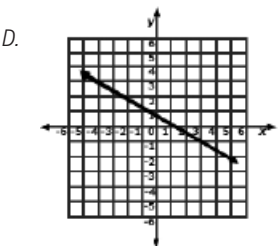
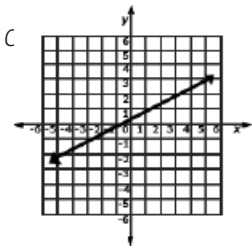
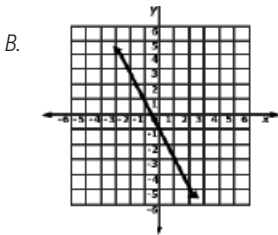
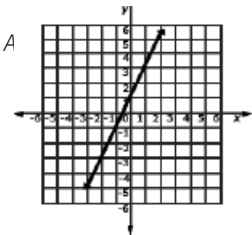
(See also 7.NSO-N.6, 7.PRA.2, AI.P.3)

**Strand: Patterns, Relations, and Algebra** *(continued)*

**8.PRA.9.** Graph a linear equation using ordered pairs; identify and represent the graphs of linear functions.

*Example: There are four different straight lines shown in the graphs below. Which of these lines contains the following list of points?*

$x$	$y$
-2	3
-1	1
1	-3



*(See also 7.PRA.4, 8.PRA.4, 8.PRA.9, 6.G.4, AI.P.5, AI.P.6, G.G.17, AI.P.5, PCT.P.4)*

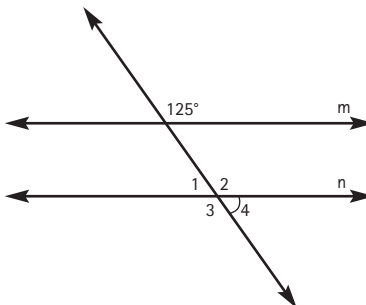
**Strand: Geometry**

**8.G.1.** Analyze, apply, and explain the relationship between the number of sides and the sums of the interior and exterior angle measures of polygons.

**8.G.2.** Demonstrate an understanding of the relationships of angles formed by intersecting lines, including parallel lines cut by a transversal.

*Example: Use the figure below to answer the following question:*

*Lines  $m$  and  $n$  are parallel. What is the measure of  $\angle 4$ ?*



*(See also G.G.1, G.G.7, G.G.12, G.G.13, PCT.G.3)*

**Strand: Geometry** *(continued)*

**8.G.3.** Demonstrate an understanding of conditions that indicate two triangles are similar: the corresponding angles are congruent (AA similarity); the ratios of two pairs of corresponding sides are equal and the included angles are congruent (SAS similarity); ratios of all pairs of corresponding sides are equal (SSS similarity).

**8.G.4.** Use a straightedge, compass, protractor, or other tool to formulate and test conjectures and to draw geometric figures.

*Example: Using a compass and straightedge, draw the perpendicular bisector of a segment, an equilateral triangle, the bisector of an angle, diagonals, midpoints, and radii, diameters, and chords of circles.*

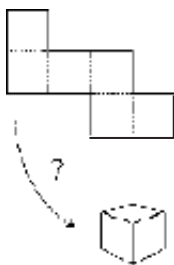
*Example: Eva has four sets of straws. The measurements of the straws are given below. Which set of straws could not be used to form a triangle?*

- A. Set 1: 4 cm, 4 cm, 7 cm
- B. Set 2: 2 cm, 3 cm, 8 cm
- C. Set 3: 3 cm, 4 cm, 5 cm
- D. Set 4: 5 cm, 12 cm, 13 cm

*(See also G.G.6)*

**8.G.5.** Apply spatial reasoning by recognizing and drawing two-dimensional representations of three-dimensional objects (e.g., nets, projections, and perspective drawings of cylinders, prisms, and cones).

*Example: Is it possible to make the cube by folding the two-dimensional shape illustrated?*



**8.G.6.** Find the distance between two points on the coordinate plane using the distance formula; find the midpoint of the line segment; recognize that the distance formula is an application of the Pythagorean theorem.

*Example: In Oak Park, a picnic table is located 70 feet from the water fountain and 90 feet from the swings. What is the longest possible distance that the water fountain could be from the swings?*

*(See also 7.NSO-C.14, 8.G.4, 8.M.3)*

**Strand: Measurement**

**8.M.1.** Given the formulas, convert from one system of measurement to another.

*Example: The largest natural lake in Massachusetts is Assawompsett Pond which has an area of 2,656 acres. What is the approximate area in square miles?*

- A. 4 sq. mi.
- B. 7 sq. mi.
- C. 17 sq. mi.
- D. 40 sq. mi.

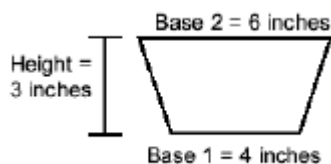
(see also 6.M.1, 7.M.1)

**8.M.2.** Understand the concept of surface area and volume; given the formulas, determine the surface area and volume of rectangular prisms, cylinders, and spheres.

**8.M.3.** Use a straightedge, compass, protractor, or other tools to formulate and test conjectures and to draw geometric figures.

**8.M.4.** Solve problems about similar figures and scale drawings. Understand that when the lengths of all dimensions of an object are multiplied by a scale factor, the surface area is multiplied by the square of the scale factor and the volume is multiplied by the cube of the scale factor.

*Example: Jamal draws a trapezoid that is similar to the one below. He draws a trapezoid with a height of 9 inches. What is the length of the shorter base of Jamal's trapezoid?*



(See also 7.M.4, 7.M.5)

**8.M.5.** Understand and use the fact that when two polygons or circles are similar with scale factor of  $r$ , their areas are related by a factor of  $r^2$ .

*Example: Two similar circular disks have diameters of  $d$  feet and  $3d$  feet. The smaller disk has area 4.2 square feet. What is the area of the larger disk?*

(See also 6.M.7, 7.M.5)

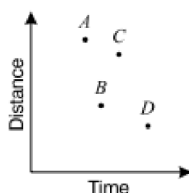
**8.M.6.** Use proportions to express relationships between corresponding parts of similar figures.

**Strand: Data Analysis, Statistics, and Probability**

**8.DASP.1.** Revisit measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data and then observe the change in each when an “outlier” is adjoined to the data set or removed from it. Use these notions to compare different sets of data and explain how each can be useful in a different way to summarize social phenomena such as price levels, clothing sizes, and athletic performances.

**8.DASP.2.** Select, create, interpret, and use various tabular and graphical representations of data (e.g., scatterplots, box-and-whisker plots).

*Example: The scatter plot below gives information about four different car trips.*



*Which point represents the trip with the fastest average speed?*

*(See also AI.P.4, AI.D.1)*

*Example: The box-and-whisker graph shown below represents the results of a survey of the estimated gas mileage of 100 car models.*



*Which statistics — mean, median, mode, range — can be determined from this graph?*

*(See also 6.DASP.1, 7.DASP.1, 8.DASP.1, AI.D.1, All.D.1, PS.6)*

**8.DASP.3.** Recognize practices of collecting and displaying data that may bias the presentation or analysis.

**8.DASP.4.** Use data to estimate the probability of future events (e.g., batting averages).

**8.DASP.5.** Select, create, interpret, and use various tabular and graphical representations of data; differentiate between continuous and discrete data and ways to represent them.

**8.DASP.6.** Apply the Fundamental Counting Principle (basic combinatorics) to find total number of outcomes possible for independent and dependent events, and calculate the probabilities using organized lists or tree diagrams.

*Example: The four finalists in the talent search will present their acts in the school talent show. Ms. King must decide which will be the first, second, third, and fourth acts in the show. In how many different ways can she arrange the four acts?*

*(See also All.D.2)*

*Picture 4 cards on a table.*



*Example: Each of the letters M, A, T, and H appear on the reverse side of one of the four cards above (one letter per card), but not necessarily in that order. If the cards are turned over, what is the probability that they will be ordered so that they spell the word MATH?*

*(See also All.D.2, PS.2)*

**Strand: Data Analysis, Statistics, and Probability** *(continued)*

---

**8.DASP.7.** Understand the difference between independent and dependent events, and recognize common misconceptions involving probability.

---

*Example: Alice rolls a 6 on a die three times in a row. Is she just as likely to roll a 6 on the fourth roll as she was on any previous roll?*

---